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Strengthening the STEM Education & Workforce Pipeline: Insights from the BHEF U.S. STEM Education Model Led to the STEM Higher Education and Workforce Project

**Naval STEM Forum
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BHEF's STEM Initiative

Seeks to answer these questions:

- Could we double the number of college graduates in the STEM disciplines in 10 years?
- What would be the highest leverage strategies to achieve this goal?



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The BHEF U.S. STEM Education Model

- Developed by Raytheon and donated to BHEF in 2009
 - Now managed by BHEF-Ohio State-Raytheon partnership
- Available through www.bhef.com Web version at:
<http://forio.com/simulate/bhef/u-s-stem-education-model/overview/>



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Doubling the Number: Insights from the Model

- **Neither K-12 strategies nor higher education strategies alone** are likely to achieve this aim
- **STEM-capable K-12 teachers are vital** to increasing the pool of likely STEM majors
- **Interest in STEM and proficiency in math are key and independent determinants** of choosing STEM major/career
- **Strengthening undergraduate education** yields an early and significant return on investment
- **Strategies and programs** have been proven to increase STEM persistence and deepen STEM learning



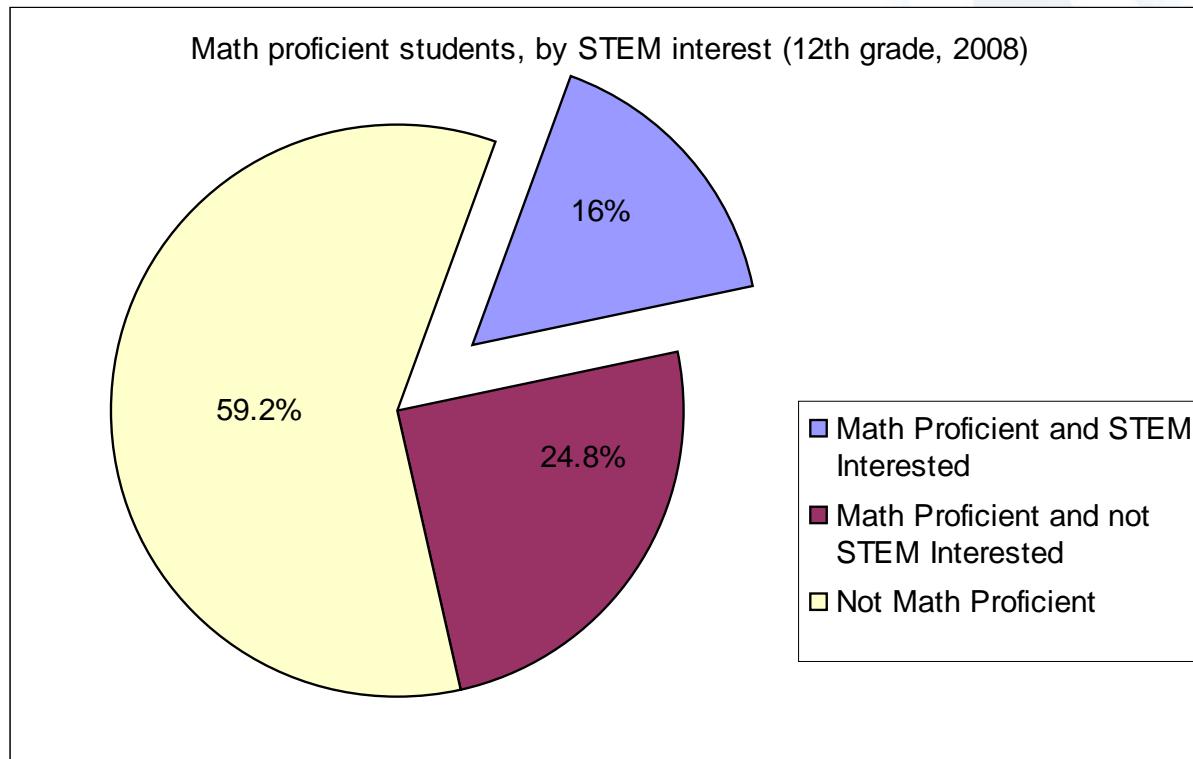
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New ACT Longitudinal Data Sets

- National Data set tracks STEM interest and proficiency from 8th grade to into college majors by race, ethnicity, income and other characteristics
- Permits data analysis and modeling of subgroups
- Permits modeling of numerous policy alternatives
- BHEF has dozens of state data sets for modeling state policy

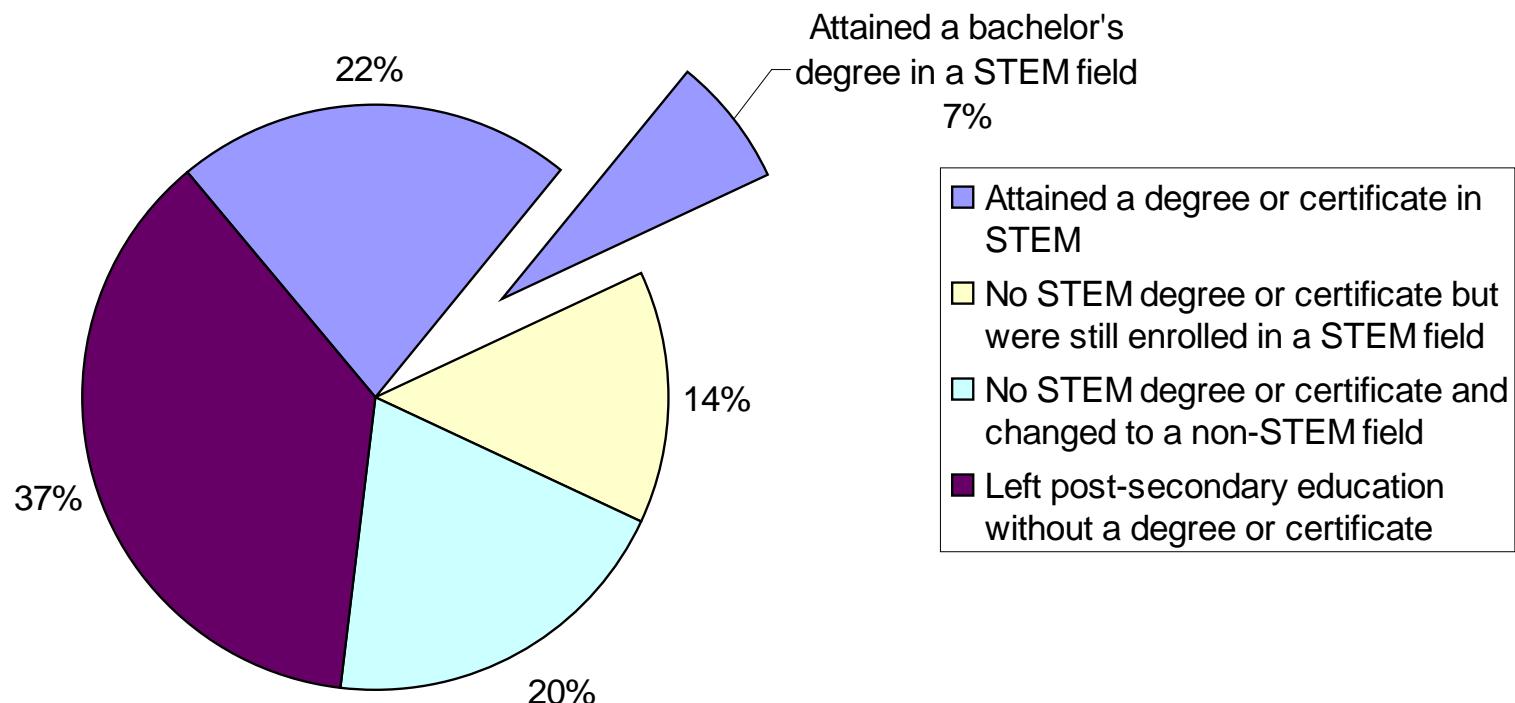
Low Levels of Interest in STEM and Proficiency in Math Among College-bound 12th Graders Results in Relatively Few Students Likely to Major in STEM or take STEM Courses



SOURCE: ACT. (2008). BHEF analysis of the EPAS Data provided by ACT.

STEM Degrees for Community College Students

2001 Degree Attainment and Persistence Among Students First Enrolled at Public 2-Year Institutions for STEM Entrants 1995-96

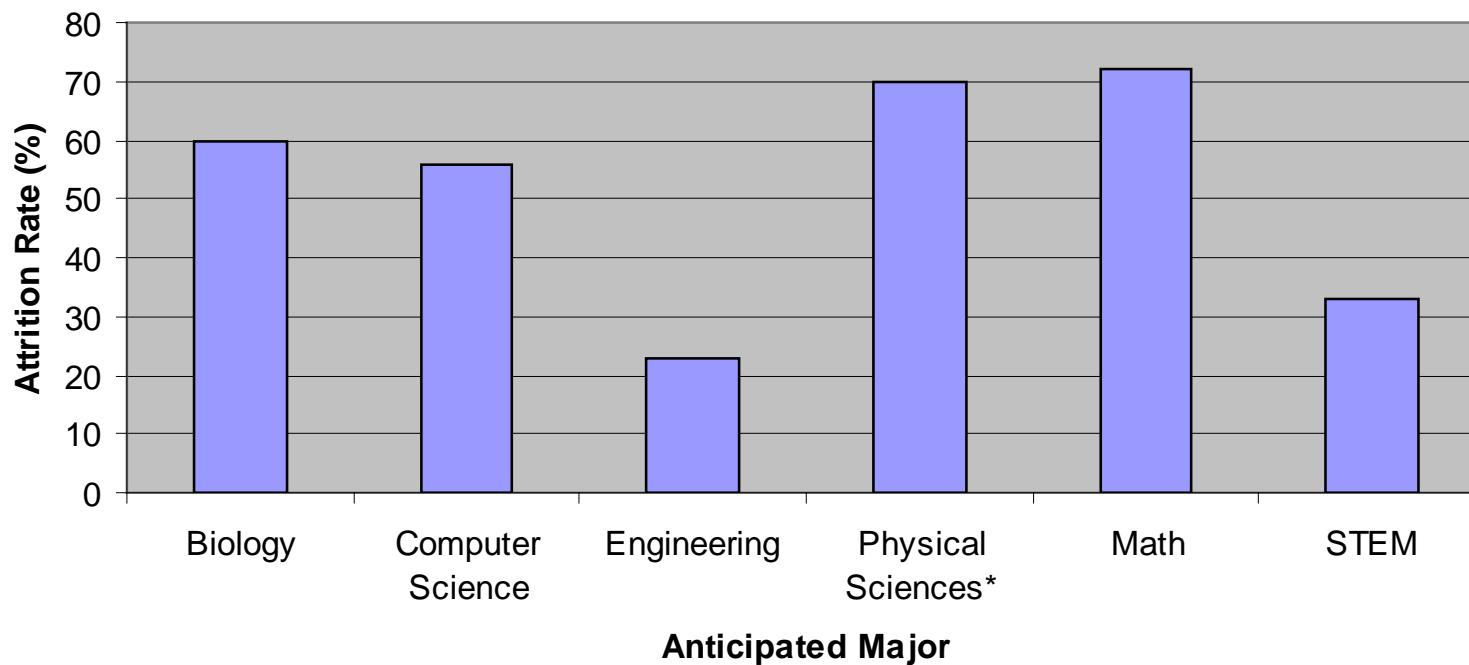


Source: Chen, X. (2009). *Students who study science, technology, engineering, and mathematics (STEM) in Postsecondary education*. National Center for Education Statistics, Institute of Education Sciences, Table 8.

Challenges to Strengthening STEM Undergraduate and Graduate Education

- Fewer than half of students who begin in **STEM disciplines** stay the course; most who change transfer to another major after first year; out migration most severe for women and minorities
- **Minority degree numbers dropping** or failing to keep pace, even among Asian-American students
- Freshmen intending to major in **S&E and engineering** is flat, but decreasing among **Blacks & Hispanics** (2004-2008)**
- **Broken pathway from community colleges** to 4-year colleges in STEM—less than 10% of transfers are STEM majors in some systems; 7.3% graduate
- **Some bright spots**, however – aerospace and mechanical engineering degrees increased and Professional Science/Engineering Masters being adopted by corporations, e.g. UMBC Cyber Security Masters

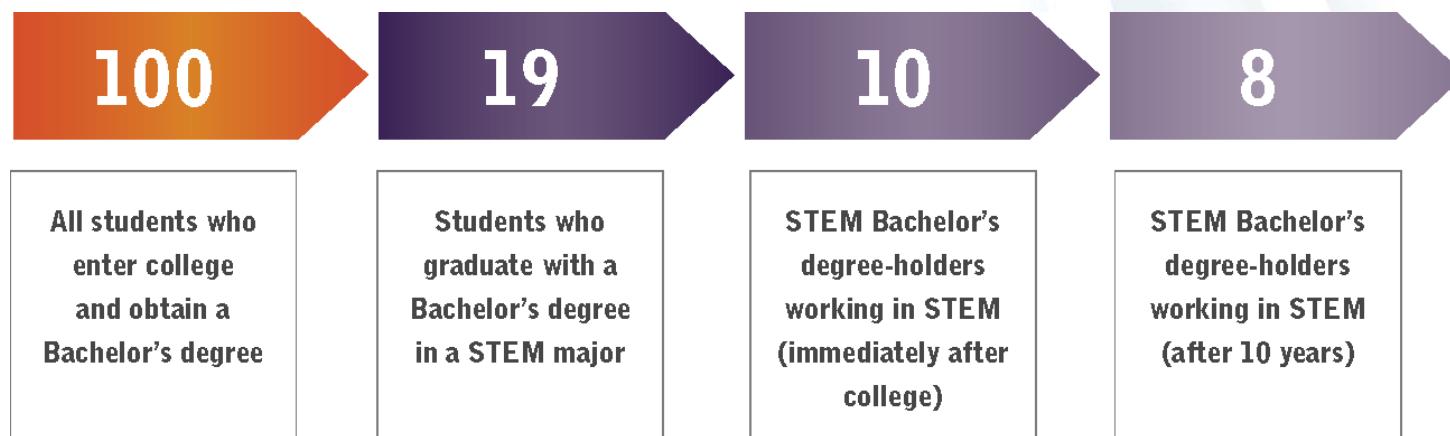
Undergraduate STEM Attrition by Major



*includes Chemistry, Physics, Earth and Planetary Sciences

Source: Koff, R., Molter, L., & Renninger, K.A. (2009). Why Students Leave STEM Fields: Development of a Common Data Template and Survey Tool. A report to the Alfred P. Sloan Foundation. 9

And only about half of STEM college graduates choose to work in STEM careers upon graduation



SOURCE: Carnevale, T. (2011). *The STEM Workforce*. Presentation to the PCAST Working Group on STEM Higher Education, April 15, 2011.

STEM Higher Education and Workforce Project: Focus on Persistence and Deepening Learning

- Led by Walt Havenstein (CEO, SAIC) and Mark Wrighton (Chancellor, Wash U)
- Data analysis and modeling;
- Research on institutional co-curricular programs, course improvement, student persistence and learning;
- Examination of external programs e.g., early internships and research that introduce freshmen and sophomores to STEM careers; and,
- An exploration of STEM skills that are essential to industry/gov.
- Pilot projects with BHEF members to improve STEM undergraduate and graduate education (MD, OH, WI)



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UMD System Pilot Project to Boost STEM Grads by 40%

- Led by System Chancellor Brit Kirwan, UMD System will:
 - Conduct migration study for STEM disciplines
 - Address first-year attrition by adopting co-curricular program, e.g., freshman research program, cohort program
 - Restructure first-year STEM courses (based on Carl Wieman's principles)
 - Collaborate with business, (Raytheon, Northrop, SAIC, Battelle), and Gov. (ONR, NSA, NIH, NIST, NASA) around skills and STEM careers



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Questions & Discussion

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